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Preparation and Administration of Intravenous Peripheral Antimicrobial Medication at a Medical Ward:

Observation Study

Helsinki Metropolia University of Applied Sciences
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Opinnäytetyömme aiheena on perifeerisen suonensisäisesti annetun antimikrobisen lääkehoidon antoprosessi. Prosessi sisältää lääkkeen valmistamisen ja antamisen painottaen aseptista tekniikkaa ja henkilökunnan hygieniaa. Opinnäytetyön tavoitteena on tuottaa ajantasaista tietoa, jota voidaan käyttää potilasturvallisuuden lisäämiseksi sairaalaympäristössä. Opinnäytetyön tutkimuskysymys on: Miten suonensisäinen perifeerinen antimikrobinenlääkkeen valmistaminen ja anto toteutuvat infektio osastolla?

Opinnäytetyömme on tehty yhteistyössä TOLA-hankkeen (Toimintamalli Laskimonsisäisestä Lääkkeenannon Oikeellisuudesta) kanssa. Tutkimusmenetelmänä on määrällinen strukturoitu havainnointi. Havainnointilomake on saatu TOLA-hankkeesta. Aineiston keräsimme Helsingin ja Uudenmaan Sairaanhoitopiirin vuodeosastolla keväällä 2014. Aineiston keräämiseen kului 8 päivää ja sinä aikana dokumentoitiin 25 lääkkeenantoprosessia.

Tulokset osoittivat, että henkilökohtainen hygienia, lääkkeen valmistaminen ja antaminen olivat oikein. Käsihygienian tekniikka on kuitenkin epäyhtenäisin osio tutkituista ilmiöistä. Myös käsidesinfioinnin kesto ja käytetyn käsihuuhteen määrä osoittautuivat ongelmallisiksi kohdiksi.

Lisätutkimus käsihygieniasta ja aseptisesta tekniikasta voisi mielestämme olla hyödyllinen. Tarkka tieto aiheesta voisi parantaa potilasturvallisuutta. Yksityiskohtainen kuvaus tutkitusta ilmiöstä antaa tarvittavaa tietoa, jonka pohjalta voidaan ryhtyä parantamaan terveydenhuollon palveluiden tasoa.

Avainsanat	Suonensisäinen, käsi hygienia, aseptiikka, antimikrobinen, perifeerinen, strukturoitu havainnointi, sairaala, lääke

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Our final project focuses on the antimicrobial intravenous peripheral medication process, and it includes preparation and administration of the medication with special attention to aseptic technique and hygiene of the involved personnel. The aim of our final project is to produce up-to-date knowledge, which can be used to enhance patient safety in the hospital settings. The study question of the final project is the following: How do qualified nurses prepare and administer intravenous antimicrobial medication at a medical ward?

This final project is carried out in association with TOLA project. The method of the study is structured quantitative observation, and the observation chart originates from TOLA project team. We collected the data at a medical ward in the Hospital District of Helsinki and Uusimaa, Finland, spring 2014. The data collection lasted 8 days and 25 medication processes were documented.

The results evidenced that personal hygiene, medication preparation and administration were correct. However, hand hygiene technique is the most inconsistent part of the studied phenomenon. Furthermore, duration of the disinfection and the amount of hand gel used are amongst the most problematic aspects.

We conclude that additional study of hand hygiene and aseptic technique might be beneficial to provide explicit data in order to improve the patient safety. Detailed description of the studied phenomenon provides the involved parties with needed benchmark to start improving the standards of healthcare services.

Keywords	Intravenous, hand hygiene, asepsis, antimicrobial, peripheral, structured observation, hospital, medication

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1 Introduction

Administration of intravenous medication is one of the common interventions in hospital environment. However, being an invasive procedure, it is naturally associated with health risk. In case of inadequate performance technique, possible negative effects may vary from minor to life threating situations, as infection. Understanding and controlling the risks, associated with intravenous medication preparation and administration is the prerequisite to minimize the hazards. (Ingram and Lavery 2005:55.)

The minimization of risks associated with nursing interventions ultimately results in holistic, thorough care for every patient. Despite exceptional standards of care and guidelines being introduced in hospital environment, it is impossible to completely eliminate medicine related mistakes in clinical practice. Nevertheless, it is possible to minimize adverse incidents by careful assessment of current practices, adaptation the best evidence-based data into guidelines and protocols, and by providing continuous training and education to the healthcare staff.

Observation of current practices in intravenous medication preparation and administration technique provides explicit knowledge on the subject. Such knowledge provides the involved parties necessary data to amend education standards, ultimately, increasing patient safety.

Structured quantitative observation is used in the final project to depict how intravenous peripheral medication is used at a medical ward, including preparation, administration, personal hygiene and aseptic technique of the individuals performing the medication process. The final project contributes to understand how intravenous peripheral antimicrobial medication is prepared and administered in hospital settings.

The purpose of the final project is to describe the practices of preparing and administering intravenous peripheral antimicrobial medication at a hospital ward. This final project is part of the TOLA (Toimintamalli Laskimosisäisestä lääkkeenannon oikeellisuudesta) project, a cooperation between Hospital District of Helsinki and Uusimaa (HUS) and Metropolia University of Applied Sciences. The observation chart used in our final project originates from the TOLA project. The aim of the TOLA project is to produce evident-based model for actions in accurate intravenous peripheral antimicrobial medi-

cation administration, with patient safety as the ultimate motive (Rekola, Korhonen, Renholm, and Vuorinen 2013:3).

2 Aspects of accurate intravenous peripheral antimicrobial medication

Jamieson, McCall, and Whyte (2007:169) define intravenous therapy as “introduction of prescribed sterile fluid into the blood circulation”. Ingram and Lavery specify that the therapy can be provided in the form of bolus injection, intermittent or continuous infusions. The use of intravenous route has its benefits compared to other administration routes. One of them is the fast onset of therapeutic effect, because the medication is directly infused into blood circulation system. This is important, if a patient has compulsory fasting or is unable to take medications orally. (Ingram and Lavery 2005:57.)

As any other medical intervention, intravenous medication has its hazards. Crouch and Chapelhow (2008:110) emphasize the risks of giving medications intravenously; it is hardly possible to revert the onset of the medication after it has been given. Overdose is a possible hazard since the bioavailability of medication is higher, compared to other routes. Ingram and Lavery (2005:58) list such risks of peripheral intravenous therapy as anaphylaxis, phlebitis, infiltration or extravasation, speed shock, fluid overload and errors associated with wrong infusion rate. These risks make intravenous therapy a hazardous procedure in terms of patient safety.

Intravenous medication administration and related hazards are thoroughly covered in the nursing research. Morris and Tay study the infection risk associated with peripheral intravenous catheterization and emphasize the importance of healthcare staff training and education in minimizing the risk of infections related to intravenous therapy. The authors pay attention to importance of clinical audit programs, which results should be shared with medical personnel, encouraging them for further training. (Morris and Tay 2008:21.)

Curran investigates the problem of medication preparation infection risks in intravenous therapy. The study concentrates on the infusate-related blood stream infections, with contamination occurring in the medication preparation stage. The author outlines the importance of aseptic technique during the medication preparation process to minimize to infection risk. (Curran 2011:7.)

The above mentioned authors accentuate the key role of nursing staff in securing patient safety when administering medications intravenously. Proper training, up-to-date protocols guide a healthcare professional in everyday practice.

2.1 Rightness of medication

Javen et al (2010:118) outline that administration of medicines is associated with risk of medical errors that can potentially occur during medication prescribing, preparing or actual administration to a patient. The five “rights” of medication is an appropriate tool to ensure safe and accurate administration of medication. Hughes (2008:5) includes the next check-points into the list:

- Right medication;
- right dose;
- right time;
- right route;
- right patient.

The right medication and dose describe the controls, done before approaching the patient. Javen et al (2010:124) indicate that unclear medical prescription interpreted by a nurse may result in a medication mistake. The nurse, preparing a medication, is responsible for checking the prescription and has the right to question any order that appears inconsistent (Berman and Snyder 2012:860). Critical judgement and practical experience allows the nurse to prevent a possible adverse situation. The medication label should be checked with the prescription to assure that the medication is correct. Later, the medication label should be verified three times; when taken from the place where it had been stored, before and after withdrawing (Berman and Snyder 2012:894).

Elliott and Liu (2010:301) claim that identification of a patient is another corner stone of accurate medication; administering a medication to a wrong patient is a common mistake. Authors advocate combining more than one method of patient identification (hospital wrist band, and medical record numbers). Patients might have no identification bands, or may be unable to express themselves. A registered nurse should always act with caution, in order not to compromise patient safety. (Elliott and Liu 2010:301.)

Medications have to be administered at the correct time; otherwise, it will result in medication overdose, or insufficient therapeutic serum level (Elliott and Liu 2010:302). Authors do not state any time interval for the administration, but outline that if a medication is being administered more than 30 minutes later than the prescribed time, it may affect bioavailability and a medication error report should be done. The time between preparation and administration of a medication also is important and should be minimized. Elliot and Liu (2010:302) point out that a medication should be prepared possibly close to the moment of administration. However, every nurse should take into account personal workload and reserve sufficient time to prepare the medication without rush and endangering patient safety.

2.2 Laminar airflow cabinet

An effective way to minimise contamination risk when mixing intravenous medication is by preparing the solution in a laminar airflow cabinet (Troy 2006:845). Such a space provides a biologically clean environment, free from particles and contaminants, therefore, both reducing risk of cross contamination and protecting the worker (Biotechnology. Performance criteria for microbiological safety cabinets 2000:5). A typical laminar airflow cabinet is enclosed from three sides with opening at the front, providing access to the working zone, where the medications are prepared. The room air contaminates the working space, and therefore, gets constantly propelled through a powerful filter, in order for decontaminated air to return to the working area in either horizontal or vertical direction (Troy 2006:845). Thus, creating a superficial air circulation circle inside the working zone.

Although, laminar airflow cabinets are biologically safe working spaces, they do not eliminate the risk of cross contamination. Thomas, Sanborn and Couldry (2005:2391) emphasize that aseptic technique of medical personnel is an important factor in eradicating admixtures' contamination during the compounding stage.

2.3 Asepsis

In administering medications intravenously, it is important to follow the aseptic guidelines, because these processes come along with infection risk. Bacteria and microorganisms lying on the skin, should not be permitted to flow with the needle into blood

flow or to the tissues. Medication and solvent should not be contaminated either or stained with the bacteria. (Nurminen 2011:32.)

Asepsis can be defined as an absence of any disease-causing microorganisms. Medical asepsis covers the practices, where it is intended to limit the access of microorganism to a particular area. According to the authors, in medical asepsis, the terms “clean” and “dirty” are used, in which clean refers to the nonexistence of microorganism and dirty refers to the possible chance of having microorganisms that can cause infection. (Berman and Snyder 2012:671.)

Transmission of microorganisms from infected individual to another, may occur in three different routes. Berman and Snyder (2012:672) point out that direct transmission occurs when two surfaces come into contact, whereas indirect transmission happens when the microorganism is introduced straight through the portal of entry (e.g. decontaminated food) or through breaking of the surface of susceptible host. The third transmission route is through air, in which the microorganism is inhaled into the respiratory tract. When the transmission route has been elected, the access through portal of entry to the susceptible host will be carried out. Susceptible host can be anyone, but those ones in a high risk are individuals with weakened immunization system. (Berman and Snyder 2012:673.)

2.4 Hand hygiene

According to WHO (2009:2), health care associated infection is a major danger to patients and it should be the first priority to focus on, to ensure the patient safety. Poor hand decontamination may be caused by faulty hand cleaning. When health care personnel fails to maintain proper hand hygiene between the care of different patients, the microorganisms are expected to transfer. After a patient contact, microorganisms are likely to remain on the hands from 2 to 60 minutes. The longer the period of care is without proper hand hygiene, the higher risks of hand contamination follows. (WHO 2009:2-5.)

Hand hygiene aims to prevent the spreading of microorganisms from health care personnel to the patient. The hands need to be washed with water and soap when they are visibly dirty, after toilet visits and after treating a patient with diarrhea causing diseases. To remove the dirt, hands should be washed with soap under water for 30 sec-

onds and after that the hands should be dried carefully. Nurses should use hand disinfectant always when entering and leaving a patient room, before and after being in touch with a patient, before and after wearing gloves or other protective clothes, before and after aseptic treatments and after contacting with patient care environment. (Ahtiala et al. 2012:115.)

The purpose of using hand disinfectant is to remove the microbial flora that has spread by being in contact with the patient or the environment around the patient. When using hand disinfectant, 3 to 5 ml should be taken, following hands being scrubbed for 20 to 30 seconds around fingertips, thumbs, palms and wrists. (Ahtiala et al. 2012:116.)

Skin care is an important part of hand hygiene; the skin needs to be clean and without any cuts. A person should not have long nails or artificial nails when working, because the microorganisms are prone to grow beneath nails. Furthermore, the use of artificial nails is forbidden in health care institutions, because it has previously caused serious epidemics. In addition to that, the use of nail polish is not permitted either, because flaky polish surface contains microorganisms. Wearing rings, watches and bracelets imperils hand hygiene and therefore is prohibited as well. (Ahtiala et al. 2012:116.)

2.5 Antimicrobial medications

Antimicrobial medications are used to treat infections caused by microbe such as bacteria, virus, fungus and protozoa. Antimicrobial medications are classified according to the intended use of it, in other words into bacteria -, virus -, fungus- and protozoa drugs. (Nurminen 2011:131.) In treating the bacteria infection, the aim is to recognize the disease causing bacteria, and according to that the most narrow spectrum bacteria medication is selected, in order to have the side effects of medication minimized. (Nurminen 2011:133).

According to Männistö and Tuominen (2001:789), biochemical reactions, which bacteria use to build up the parts of the cell can be divided into three phases. First phase of biochemical reaction occurs when the cell uses glucose to enable the synthesis. In the second phase, the cell uses energy to produce for instance amino acids, nucleotides, phospholipids and carbohydrates. The final stage is reached when the cell begins to produce macro molecules such as proteins, nucleic acids, polysaccharides and pepti-

doglycans. Deactivation of these processes can be carried out by attempting to disrupt any of this processes. (Männistö and Tuominen 2001:789-790.)

New medications are not easily created and they are very rarely more effective than the old medications regardless the fact that they are more costly. Resistance of bacteria should be fought with cautious medication use. The use of antimicrobial medications for prophylactic effect tends to rather increase the risk of complications than to decrease it. This occurs because antimicrobial medication exterminates sensitive bacteria as well as the ones that are part of our normal flora. (Männistö and Tuominen 2001:791-792.)

When it comes to resistance, problems arise daily in clinical work, but especially in the hospitals bacteria resistance is an issue (Huovinen 2013). Because antimicrobial medications are used so commonly, there is no solution to be freed from bacteria resistance (Huovinen 2013). According to Nurminen (2011:134), heavy use of bacterial medications may lead to bacterial resistance, when the antimicrobial medication no longer have an effect. Some of the bacteria are naturally resistant to specific medical substances. However, certain bacteria (e.g. staphylococci, pseudomonas) have an ability to transform and develop different resistance mechanisms, which they use to antagonize the used medical substances (Nurminen 2011:134). Prevention of resistance comes simply from minimizing the use of antimicrobial medications and inhibition of spreading of bacteria by maintaining proper hand hygiene (Huovinen 2013).

As the resistance develops, the higher doses of antimicrobial medications are needed to prevent bacteria growth. The development of bacterial resistance can be examined by exposing the growing bacteria to an antimicrobial medication. At times, resistance is developed instantly, but usually it requires multiple alterations and resistance grows gradually. The authors discuss that if the bacteria sampling is necessary, it should be completed before the initiation of the therapy, because sampling during the microbial therapy may lead to false results. (Männistö and Tuominen 2001:792.)

Ineffectiveness of the antimicrobial therapy may occur, because the onset of therapy was initiated too late or the dose has been too minimal. Some of the bacteria may be in inactivity, indicating that very rare microbial medication can be effective to kill them. Furthermore, some of the substances may not reach the abscess in the wound area,

because they have no blood circulation; hence a surgical procedure is needed to defeat the infection. (Männistö and Tuominen 2001:793.)

Larmila (2010) states that it is important that the medication is administered evenly within the 24 hours, hence to have the effect of medication distributed evenly, in order to secure efficacy of the therapy. Intravenous medications should be diluted and infused according to the hospital policy or Pharmaca Fennica. It should be noted that antimicrobial medications interact with numerous other drugs and, therefore the compatibility should be ensured before administering. (Larmila 2010.)

Nurminen (2011:132) mentions that in the case of antimicrobial medications, it is important to follow the dose instruction and dose intervals. Even though the symptoms may ease in the beginning of treatment, the medical treatment should be continued until the end of the regimen, to prevent the disease to recur. Too short regimen may lead to having the resistant bacterial strain to develop again. (Nurminen 2011:132.)

3 Purpose and study question

The purpose of the final project is to describe the practices of preparing and administering intravenous peripheral antimicrobial medication at a hospital ward. The study question of the final project is the following: How do qualified nurses prepare and administer intravenous antimicrobial medication at a medical ward?

The aim of the final project is to offer valid data that can be later used to improve the patient safety by minimizing the risk related to intravenous peripheral antimicrobial medication. Furthermore, the final project will help to get explicit outcomes that will eventually assist to improve health care in the future. The study enables to come up with superior approaches to the accurate intravenous peripheral administration to guarantee patient safety.

4 Methodology of the study

In order to answer the study question, quantitative research approach is carried out by using observation study. Quantitative research can be defined as a research in which a particular phenomenon is studied by collecting numerical data. Often, data does not

exist in numerical form, hence the phenomenon needs to be converted in such way that it can be measured numerically. (Muijs 2004:1-2.)

In this final project the phenomenon studied is the medication process which entails preparation and administration of antimicrobial intravenous medication, with additional consideration about hand hygiene and aseptic technique of the personnel. The numerical data is collected by observing medication processes, in other words, how nurses prepare and administer the antimicrobial intravenous medication at a medical ward. For the analysis of quantitative research, the mathematically based method is used to measure the phenomenon.

4.1 Observation study

Observation is a method to collect data in a sense that observer records according to what he/she observes (Järvinen and Järvinen 2004:154). In this study the object of observation is hospital personnel's actions in preparing and administering intravenous peripheral antimicrobial medication. This observation study was conducted in one of the university hospitals of the Hospital District of Helsinki and Uusimaa, (HUS), Finland.

According to Järvinen and Järvinen (2004:155), observation may depend on the coincidence, because perchance not all different events arise during observation period and additionally, the observer's ability to notice everything during observation also accounts to the results. Observation is not simply "watching" the objects, but it relies on both eye sight and hearing (Bowling 2002:358). The structured observation means that it has been defined in advance what is to be observed, whether it is the actions or events etc. (LiBiondo-Wood and Haber 2010:272).

4.2 Observation chart

The observation chart, used in this final project, is the "Havainnointilomake lääkkeenannon oikeellisuuden ja aseptiikan toteutumisesta", copyright of Korhonen, Rautajuuri, Saarinen, Säynäjärvi, Toivonen, Rekola. The total number of items is 60; 45 of those are close-ended items and 15 opened-ended. The items are divided into six sections. The observation chart is shown in the appendix 1. Short description of the observation chart is given below.

Section one has nine items and presents general information about the event being observed, such as: time, official title of the person whose actions are being observed, professional experience in years, name of the medication being administered and a special field for additional comments regarding observation.

Second section, having eight items, concentrates on nurse's personal hygiene status, featuring items about hairstyle, jewelry, rings, wrist watch, nail polish, artificial nails, hand skin status and propriety of work outfit.

Third section consists of items regarding hand disinfection and its technique (seven and nine questions respectively). It is verified, whether a nurse disinfects hands before preparing a medication; before and after physical contact with the patient; prior and after using gloves. Disinfection technique is verified to be accurate: sufficient amount of disinfection gel used, disinfection continues long enough and hands' disinfection technique is appropriate.

The sixteen items of the fourth section are dedicated to medication preparation. It is checked whether: the medication and dose are the right ones, protective gloves are used when preparing the medication, infusion set does not contain air, medication has a valid expiry date, the medication had been stored appropriately before the preparation, coating surface is disinfected prior to perforation, presence of residual fluid in the compounding container, after emptying it, accurate labeling of the infusion solution, time between preparation and administration of the medication and appropriate usage of a laminar cabinet.

Section number five consists of eight items about administration of medications. Whether patient's identity is checked, administration time being the right one, the right infusion rate, presence of residual solution in the medication container after the medication is stopped, infusion set being flushed, or not. The final, sixth section has three questions about the peripheral cannula, depicting the overall usability of the cannula and the skin condition at the sight of perforation.

4.3 Data collection

The data collection, carried out under this final project, encompasses patterns of quantitative research paradigms. This allows observers to investigate the problem in the natural settings and to produce empirical quantitative data that can be further processed using statistical methods. The observation results are recorded according to the observation chart described above. Besides the paper copies of the observation chart, no other means of documenting is being used. The observation lasted for 8 days in spring 2014, with one day dedicated to pilot testing.

Bowling (2005:364) points out the unavoidable risk of contaminating the observation results by the presence of observers to the scene. Observers aimed to minimize that risk by avoiding personal interference with the patients and reducing interpersonal contact with the ward personnel out of the observation settings to a reasonable limit.

The observation is conducted by two observers. Both observers monitor the medication process simultaneously in order to ensure observation objectivity. Bowling (2005:364) states that “objective observations are impossible to achieve”, however, comparing the results of different observers is an effective method to eliminate subjectivity of the research results. Time sampling of the observation is another important stage of data collection. The observation was carried out according to the agreed schedule.

4.4 Data analysis

The results of the observation was recorded according to the observation chart and represented in numerical data. The results are described and summarised using methods of quantitative data analysis, such as descriptive statistics. Descriptive statistics provides the reader generalised figure of the collected data (Moule and Goodman 2009:327).

At first stage, the data of both observers was compared between each other. The results of two observers are presented separately. Comparability of two record sets is evaluated using 0 to 100 percent scale. Later, the results were analysed with the use of Microsoft Office Excel 2013 software. Analysed data was summarised and presented in figures and tables. Total count of results was presented in numerical and percentage

count. Fulfilment of every statement in the observation chart was calculated and described as numerical and percentage count.

In order to summarize and present coherent results, correspondence rate equation was used. In this final project correspondence rate means the extent, to which two observers document a particular item similarly. The correspondence ratewas calculated in percentage according to the formula used by Utti and Veltheim (2014:16).

5 Results

The total number of observations analysed was 25. In the 25 observations there were six different intravenous medications. Nevertheless, 28 medication processes were observed, and three observations were excluded from the final analysis. Two out of the three were pilot testing and were excluded due to poor general quality. One observation was excluded from the total count, because observers did not follow the phenomenon until the end.

The biggest amount of observations in one day was 5, the minimum - 2. The simple mean number of observations per day was 3. In 13 cases (52 per cent) there were two employees involved in the medication process. In 12 cases (48 per cent) all the actions were performed by one person. The personnel's working experience was inquired during the observation. The maximum working experience was 29 and the minimum was 1 year. The simple mean working experience was 13 years.

The time, the observations began, was also documented. Thus, the observations can be grouped into three sets: morning (around eight o'clock in the morning), noon (around noon) and afternoon (around 16 o'clock in the afternoon). The largest amount of the observations (14 cases, or 56 per cent) was done in the afternoon, 9 observations, or 36 per cent, were conducted in the morning, and 2, or 8 per cent at noon. The distribution of observations during the day was subject to antimicrobial medications administration regimen (eight hours in most cases).

5.1 Personal hygiene of a medical professional

Both observers had the same findings regarding personal hygiene of the personnel. Long hair was tied up in 100% of the observations. Staff members had no jewelleries when preparing or administering antimicrobial medications. None of the personnel wore rings or wristwatch during the observations. No nail polish or artificial nails were worn. The overall hand skin condition was flawless in 100 % of the observations. In one case out of 25 observations (4 %), the person, participating in the medication process, wore a garment, which was not allowed by the local hospital policy. The detailed data for this section is provided in Appendix 3, and the frequency of “yes” answers in percentage count and correspondence rates for every item are presented in figure 1.

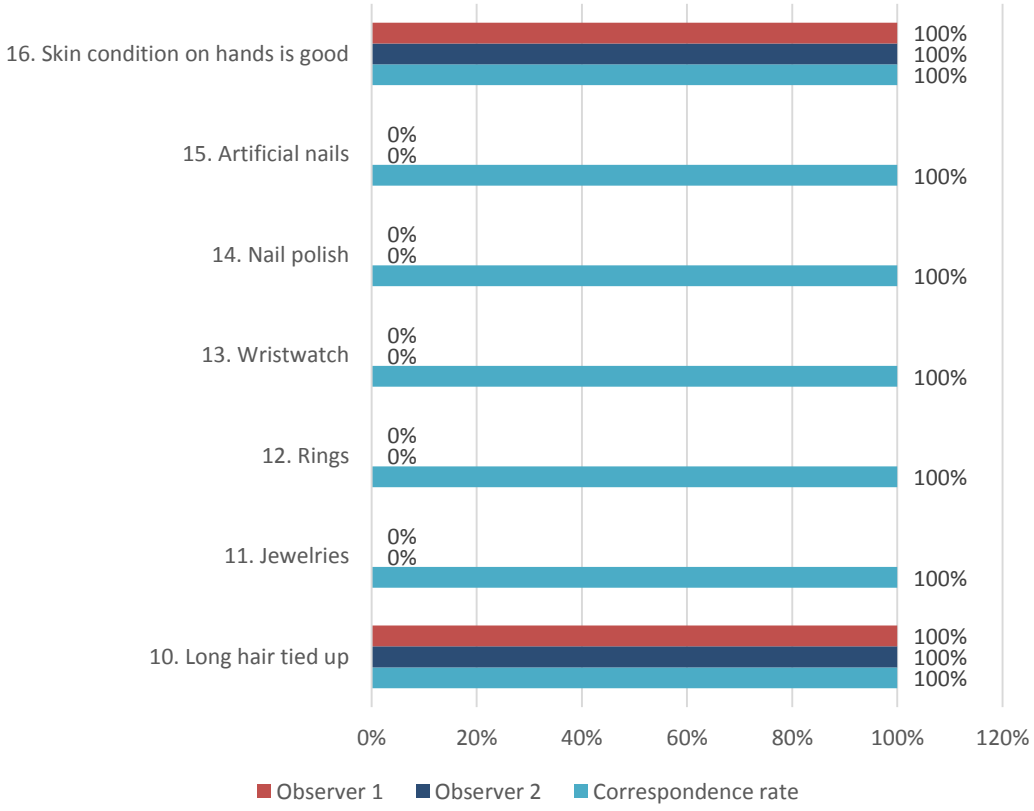

Figure 1. The frequency of “yes” answers in percentage and correspondence rates for “Personal hygiene”.

5.2 Fulfilment of the hand hygiene

In the following section of the observation chart, performance of hand hygiene was documented. The detailed results for this section can be found in Appendix 4, and the

frequency of “yes” answers in percentage count and correspondence rates for every item are presented in figure 2.

In 92 % of the cases personnel disinfected hands before preparing medications. However, the observers showed unequal results between each other. Whilst according to observer 1 hands were disinfected in 88 % of the cases, observer 2 indicated that hand disinfection before medication preparation was done in 96 % of the cases. Findings on whether personnel disinfected hands before and after contacting a patient varied as well. While observer 1 had 80 % and 100 % respectively, observer 2 had 92 % and 100 % in turn. The correspondence rates between the observers’ results were 88 % and 100 % correspondingly.

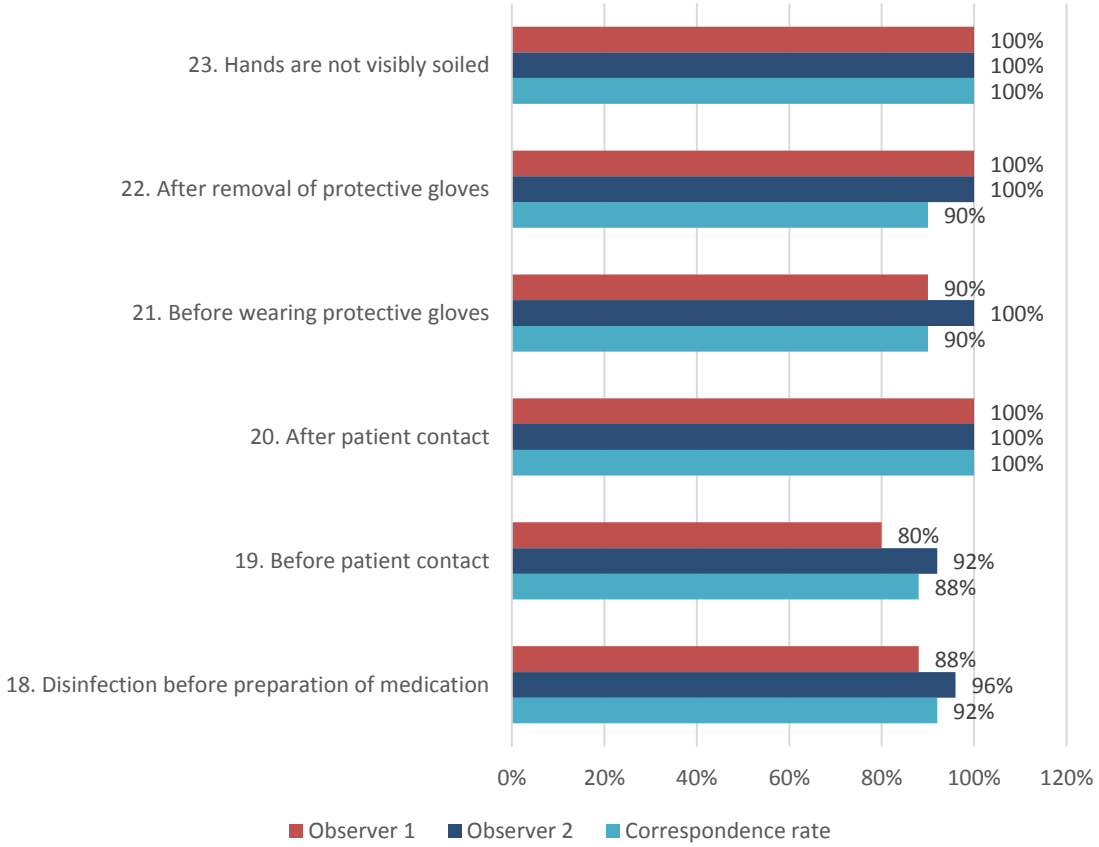

Figure 2. The frequency of “yes” answers in percentage and correspondence rates for “Fulfilment of hand hygiene”.

Hand disinfection before and after using protective gloves happened in 100 % according to observer 2, whereas observer 1 recorded it to happen in 90 % of the cases before putting on protective gloves and in 100 % after using such. Moreover, the observers did not have similar finding about the number of times when personnel used protec-

tive gloves. Thus, observer 1 documented it to happen 10 times, whilst observer 2 documented it 9 times. Due to the formula used to count the correspondence rate between the observers' data, the correspondence rate is 90 % for both items. Both observers had the same opinion that the personnel had visibly unsoiled hands.

5.3 Hand disinfection technique

Out of the eight questions, covering the hand hygiene technique, both observers had absolutely same finding related to one question only. The detailed results for the section can be found in Appendix 4, and the frequency of "yes" answers in percentage count and correspondence rates for every item are presented in figure 3.

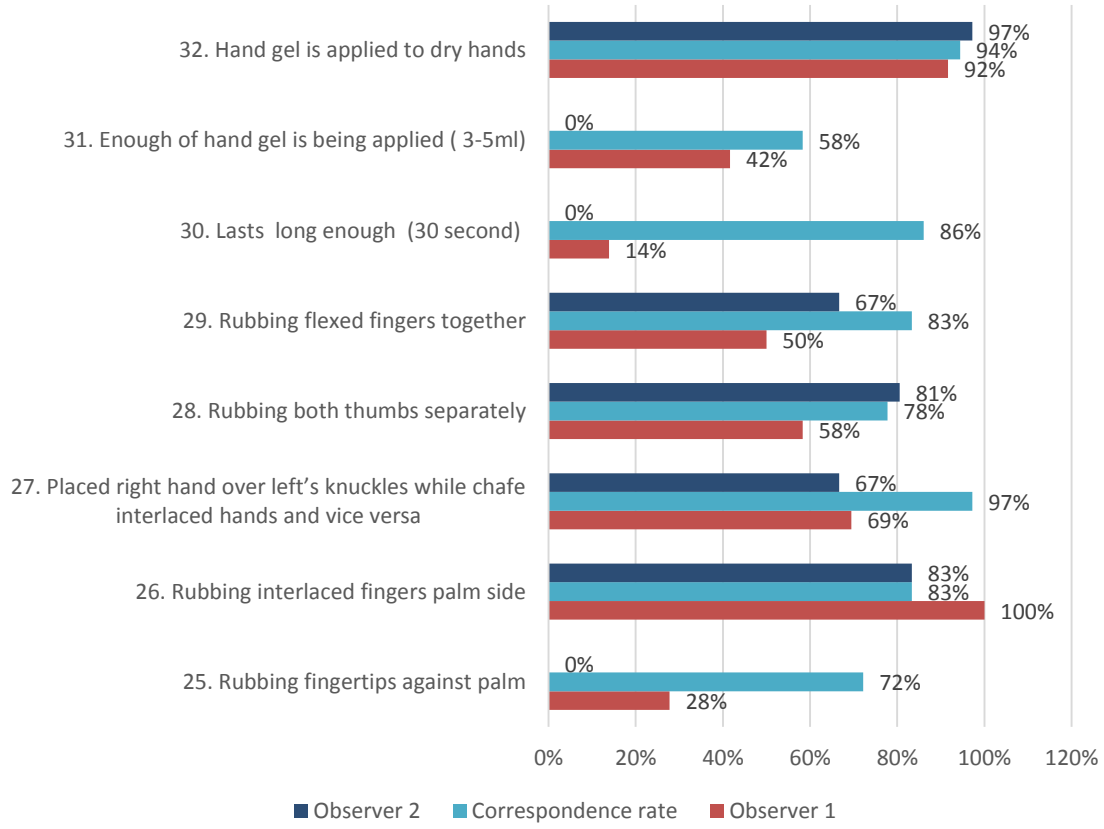

Figure 3. The frequency of "yes" answers in percentage and correspondence rates for "Appropriate technique".

Within the technique section, both observers documented that rubbing of the fingertips against palms happened to the lowest degree. Observer 1 documented it 10 times (28%), and observer 2 in 0 cases. Rubbing palms together with interlaced fingers was

recorded 36 times (100%) by the observer 1 and in 30 cases (83%) by the observer 2. The item with the highest correspondence rate, rubbing the backs of the both hands with fingers interlaced was documented in 25 (69%) and 24 (67%) respectively.

The employees rubbed both thumbs separately in 21 cases (58%) according to observer 1 and in 29 cases (87%) according to observer 2. Rubbing flexed fingers together was recorded 18 (50%) of the times respectively by observer 1 and 24 (67%) of the times respectively by observer 2. Both observers had similar opinion about whether personnel applied hand disinfectant onto dry hands: 33 (92%) versus 35 (975) of the cases. The essential results were recorded about the amount of hand gel used and the length of the hand disinfection process. Observer 1 recorded enough amount of hand gel to be used in 15 cases (42%), whilst observer 2 recorded it in 0 number of cases. The sufficient duration of hand decontamination was documented 5 (14%) times and 0 times respectively.

5.4 Preparation of medication

Both observers had identical findings regarding the preparation of the medication. Despite that, there is still discrepancy between the two observers' data. The detailed results for this section can be found in Appendix 5, and the frequency of "yes" answers in percentage count and correspondence rates for every item are presented in figure 4.

In the preparation of medication, the correct medication and correct dose was marked to be 25 times by both observer. Hence, the correspondence rate was 100%. Additionally, the gloves were observed to be used by both observers in 25 cases during preparation, giving the correspondence rate 100%. The observer 1 had 25 "yes" for the infusion set not containing air after assembling, whereas observer 2 had 24 "yes" and 1 "no", the correspondence rate in this case is 96%. Both observes marked 25 times that medication was not expired and it had been stored correctly, giving the correspondence rate 100%. Medication containers' perforated surface was cleaned with antiseptic agent before attaching transport cannula or infusion set in 24 cases by both observers, the correspondence rate was calculated to be 100%.

The observer 1 marked 16 cases of residual infusion and 9 cases of no residual infusion, whereas the observer 2 marked 18 cases of residual infusion and 7 cases of no residual infusion. The correspondence rate for answer of two observers was 92%.

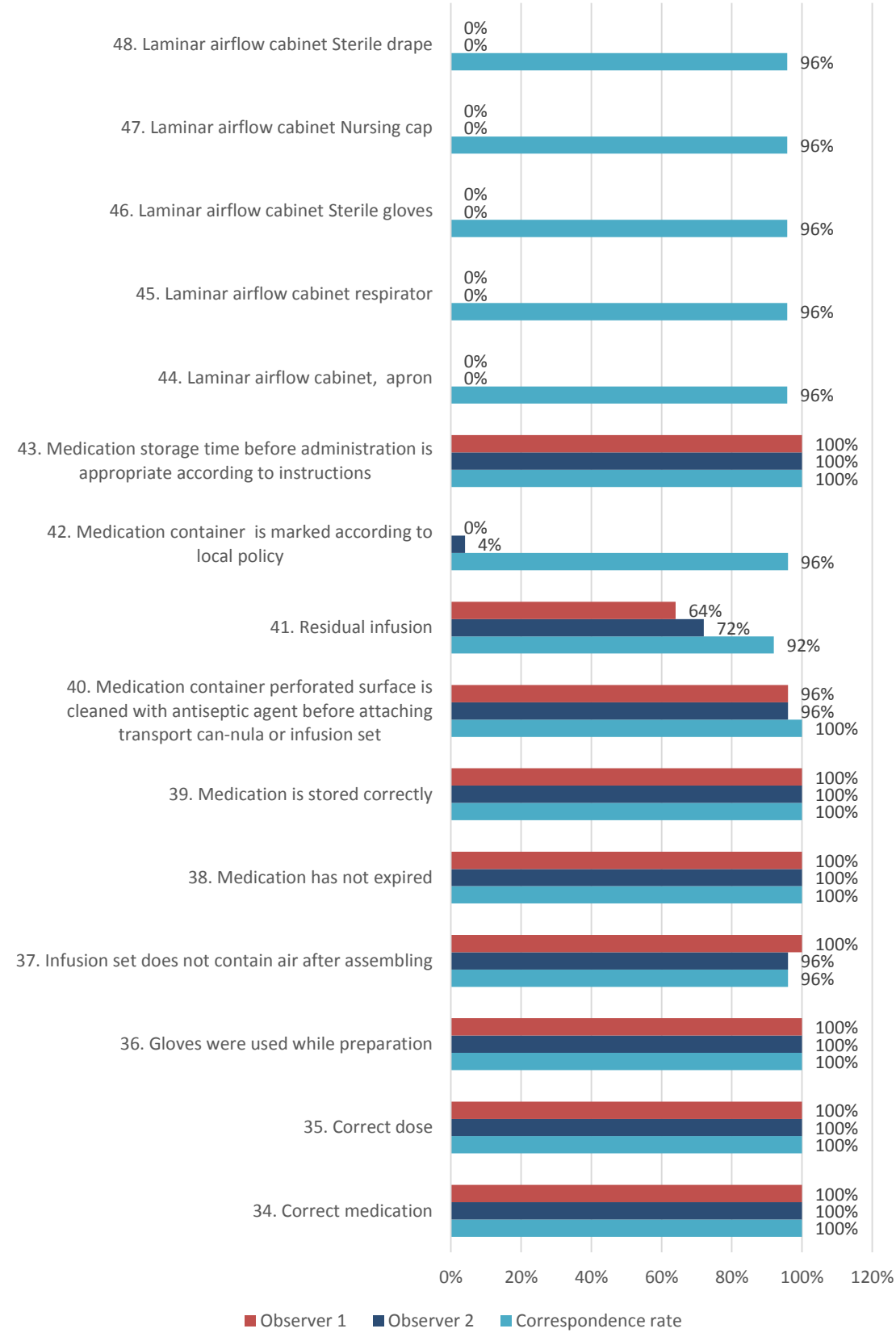

Figure 4. The frequency of “yes” answers in percentage and correspondence rates for “Preparation of medication”.

Observer 1 noticed 25 cases of medication label not being marked correctly, and observer 2 noticed 24 cases where it is marked incorrectly and 1 case where the medication label was correct. The correspondence rate was 96%. Both observers agreed on that the medication storage time before administration is appropriate according to instructions, both have 25 “yes” answers and the correspondence rate was 100%.

The observers had contradictory results about how many times laminar cabinet was used to prepare a medication. Observer 1, who stayed outside the laminar airflow cabinet room, noticed laminar airflow cabinet being used 24 times. Whilst observer 2, who was inside the room, marked 23 cases. Such a discrepancy between the two observers’ data explains the fact that having similar readings in items 44 - 48, the correspondence rate does not reach 100 % range. Observer 1 reported that in those 24 cases where the medication was prepared in the laminar airflow cabinet, none of the personnel wore an apron, a respirator, sterile gloves, nursing cap and sterile drape. Therefore, 24 “no” answers were marked for to laminar airflow cabinet: apron, laminar airflow cabinet: respirator, laminar airflow cabinet: sterile gloves, laminar airflow cabinet: nursing cap and laminar airflow cabinet: sterile drape.

The observer 2 observed 23 cases when the medication was prepared in the laminar airflow cabinet and 2 cases when the medication was prepared outside of it. In those 23 cases, the observer 2 marked that none of the personnel wore an apron, a respirator, sterile gloves, nursing cap and sterile drape. Hence, 23 “no” answers were marked for to laminar airflow cabinet: apron, laminar airflow cabinet: respirator, laminar airflow cabinet: sterile gloves, laminar airflow cabinet: nursing cap and laminar airflow cabinet: sterile drape. This gives the correspondence rate of 96% between the two observers to laminar airflow cabinet: apron, laminar airflow cabinet: respirator, laminar airflow cabinet: sterile gloves, laminar airflow cabinet: nursing cap and laminar airflow cabinet: sterile drape.

5.5 Administration of medication

In administration of medication, observer 1 noticed 15 cases where old infusion sets were used and 10 cases when old infusion sets were not used. In these 15 cases, observer 1 marked that all of them were preserved aseptically in the stand. Observer 2 noticed 16 cases of use of old infusion sets and 9 cases when the old infusion sets were not used. In these 16 cases, observer 2 marked that all of them were preserved

aseptically in the stand. The correspondence rate for the use of old infusion sets was 96% and for whether the old infusion sets were preserved aseptically was 94%. The detailed data for this section of the observation is presented in Appendix 6, and the frequency of “yes” answers in percentage count and correspondence rates for every item are presented in figure 5.

Both observers noticed in 25 cases that patient identity was not checked; therefore the correspondence rate was 100%. Observer 1 felt that the correct time of administration was in 24 cases and in 1 case was incorrect, whereas the observer 2 felt that in 18 cases the administration time was correct leaving 7 cases of administration to be incorrect.

In the evaluation of cannula, both of observers agreed that in all of 25 cases the cannula was usable, hence, correspondence rate was 100%. The cannula was assessed to be usable if the solution was able to flow into vein. However, in assessing the environment of cannulation site, observer 1 felt that in 24 cases it was healthy, and in 1 case the environment was not healthy. On the other hand, the observer 2 assessed the environment of cannulation site to be healthy only in 19 cases and in 6 cases it was not healthy. This concludes into correspondence rate of 80%. In this item, the assessment was made to see if there were any complications of cannula, such as irritation of the skin or edema.

Time interval for correct medication time was settled to be up to 30 minutes from prescribed administration time. During the morning or evening shift, the nurses had many patients who required different intravenous medications at the same time and therefore it was impossible to administer the medication on the exact time for every patient.

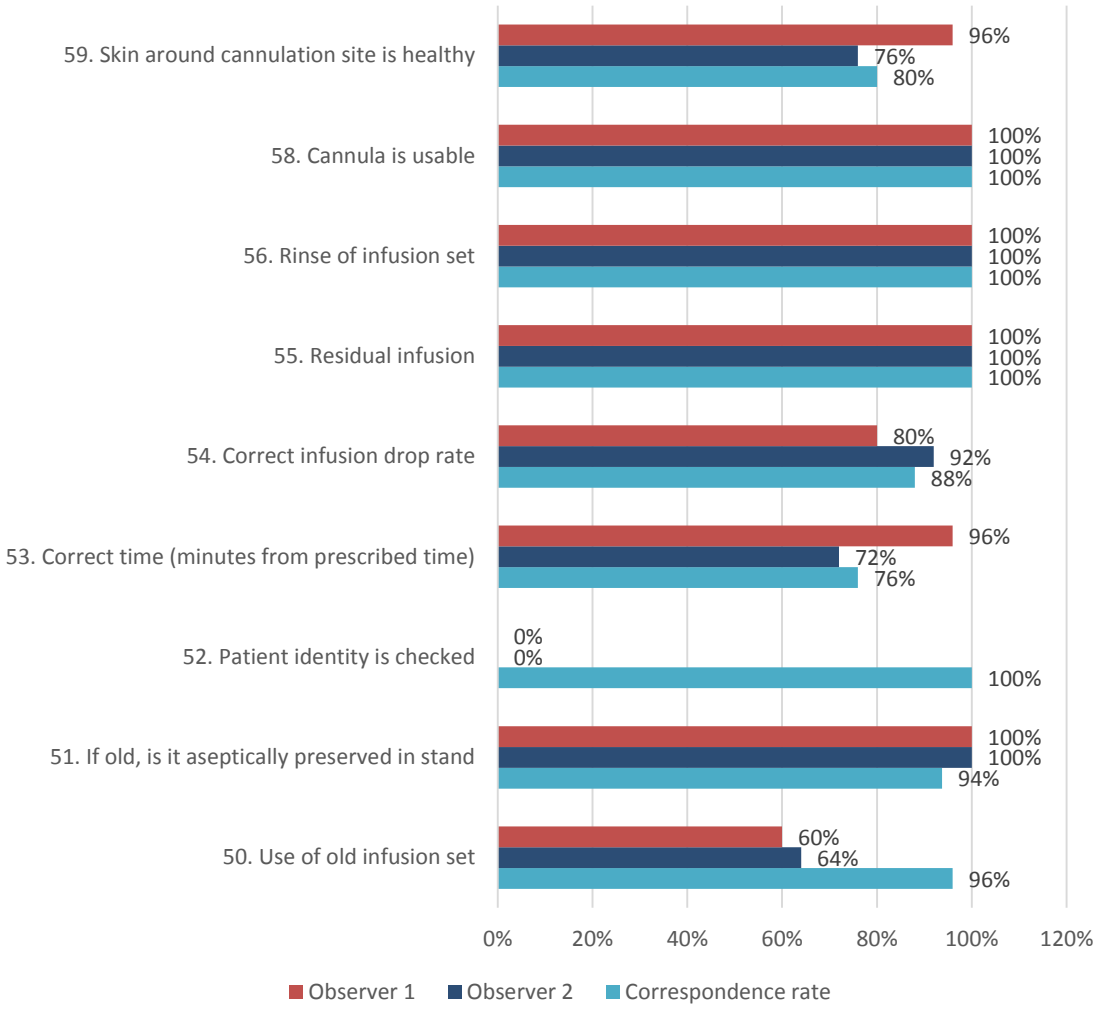

Figure 5. The frequency of “yes” answers in percentage and correspondence rates for “Administration of medication”.

For the observer 1, the correct infusion drop rate was in 20 cases and in 5 cases it was not, whereas for observer 2 the correct infusion drop rate was 23 and in 2 cases it was incorrect. The correct infusion drop rate was marked according to physician’s’ instructions. For residual infusion and rinse of infusion set, both observers ticked “yes” for 25 cases therefore, correspondence rate is 100%.

6 Discussion

Having conducted the observation study, we surveyed the patterns of intravenous peripheral antimicrobial medication preparation and administration at a medical ward. The collected data answered the study question in the extent the observation chart allowed.

We found ward staff's personal hygiene to be on a high level. The employees did not wear rings or wrist watches, kept long hair tied up and the overall hand skin condition was found to be good. Medication preparation process was seen to meet high standards. All the prepared medications were the prescribed ones, with the dose to be correct. The drugs had been stored correctly before the preparation and none of the drug had expired. In all but one cases the assembled infusion sets were air free, and medication containers' perforated surfaces were disinfected before puncture. During the administration phase we documented that the cannulas were always rinsed after medication administration. We also documented that the infusion sets used more than one time were aseptically kept at the bedside. The cannulas were seen as functional in all of the observations.

The most controversial section of the observation is the hand hygiene technique. That section presented the lowest positive scores correspondence rate of 58 %. The differences in the findings between the two observers might have several explanations. Hand disinfection is a relatively quick procedure which is performed in a very short time to be properly observed. In at least 88 % of the cases the disinfection lasted less than 30 seconds. The observer 2 recorded 100% of cases where enough hand gel was not applied. When hand gel was applied enough, the disinfection would last 30 seconds, allowing observers sufficient time to observe and document hand disinfection technique. That makes its observation extremely challenging for an observer.

Furthermore, the hand disinfection is a routine action, which healthcare providers perform numerous times during a day. Furthermore, when an employee disinfected hands several times during one medication process, observers might have documented disinfection occurring in different phases of a medication process. That, inadvertently, might have had a dubious effect on the observation results. Moreover, often position of the observed employee didn't allow the observers to make apparent decision about the event, causing different observation results.

The different readings mean that the hand hygiene technique was not explicitly documented in the present project. However, hand hygiene technique is an important factor in medication process guaranteeing patient and personnel safety. Therefore, additional study of the hand hygiene patterns might give broader understanding on the question how to guarantee patient safety in preparation and administration of intravenous peripheral antimicrobial medication.

Besides the hand disinfection technique, we found the filling in of medication labels to be inconsistent. In all of the observations the name of the person, who prepared the medication was missing from the labels. The ward staff strived to ease medication preparation by printing ready the medication labels, which were later attached to medication bottles or vials. These labels had ready the medication substance, patient bed number, time and date. The name of the person who prepared the medication was missing from the labels. Every individual who prepared the medication was required to fill in that part of the label after preparation of medication.

Another incident we found to be inconsistent was the residual infusion, left in the vial in a medication preparation and administration stages. The usage of transfer cannulas during medication preparation and administration inevitably resulted in residue fluid in the vial. It was not due to incompetence of the staff, but the location of the transfer cannula hole did not allow all of the fluid to pass over the other vial. Any residual solution in the bottle was considered to be a residual infusion, the volume of residual solution was not measured. However, in the instances when syringe instead of transfer cannula was used to transfer the medication in the preparation phase, no fluid residue was documented.

The difference in the result of the amount of medication prepared inside the laminar airflow cabinet is explained by the distance of observation of two observers. During the observation, the observer 1 stood outside the laminar airflow cabinet room whereas the observer 2 stood inside the laminar airflow cabinet room. Therefore, the observer 2 had a chance to see that one medication was prepared inside the laminar airflow cabinet room, but not inside the actual laminar airflow cabinet.

6.1 Biases of the research

One of the biases in our final project is the limited number of observations. We observed 25 medication processes, which may not be a sufficient sample to answer the study question in a credible manner. The time allocated for the data collection phase was not sufficient due to difficulty in estimating the amount of medication processes occurring within the data collection time. It was not possible to anticipate how many patients received intravenous antimicrobial therapy. Furthermore, the antimicrobial

medications are simultaneously given to different patients according to a repeating timetable. That significantly reduced the number of observations.

During the data collection phase, we encountered several incidents, which was not possible to integrate into the observation chart structure. For example, the observation chart had only one item for cleaning the perforated surface of the medication container that was considered for the preparation phase. In reality, the perforated surface should be cleaned also before attaching infusion set in the administration stage.

Furthermore, hand hygiene technique assessment is in the observation chart only once, even though it occurs multiple times; before preparing the medication and before and after the medication is administered to the patient. It was unclear for observers, in which moment the hand hygiene should be documented. The hand disinfection did not necessary always occur before preparing the medication and therefore, in some cases the assessment of hand hygiene was observed when the nurse disinfected the hands before or after administrating the medication.

In addition, in majority of cases, there were two persons involved in the medication process. Therefore, the personal hygiene and fulfillment of hand hygiene required observation twice and the observation chart only had place for one observation. That led to a confusion in the pilot testing phase, with later amending the observation chart by adding the second person row into the observation tool.

Even though the observers attempted to minimize contact with the patients, only to observe the nurses' medication administration technique from apart, most of patients were curious to know more about the observers or the observation study, therefore, had many questions. This may had as well disturbed nurses' work affecting observation results.

Before the observation study was initiated at the ward, a presentation and introduction to the observation study was made to the ward personnel. Observers clearly pointed out in the beginning that the intention of the observation study is to observe how intravenous medication is prepared and administered at the ward, hence the observation object was the medication process, not the nurses. Despite that, it was noticeable that nurses felt stressed when being observed. Regardless of the information provided beforehand, the nurses may have felt that they were under surveillance.

6.2 Comparison with the previous studies

Earlier several final projects have been carried out on the same topic, in association with the TOLA project. The results of our final project comply with Kantojärvi and Karjalainen, who documented healthcare professionals' personal hygiene as faultless. The same authors identified hand hygiene technique as the most controversial part. (Kantojärvi and Karjalainen 2014:24.) Rautajuuri and Toivonen (2012:26) likewise describe the observation of hand hygiene technique as complicated, with the results to be occasionally questionable between the two observers.

Besides the similarity in the large scale results different authors sometimes had distinctive understanding of the observation phenomenon, and corresponding observation methodology seem to be understood differently by different observer groups. In our work, the phenomenon is a medication process, concerning one medication, single patient and the staff. The medication process begins with medication preparation and finishes when the infusion set is rinsed after the administration. In contrast, Rautajuuri and Toivonen (2012:17) often observed the preparation of one medication, and administration of another. So the same medication was rarely observed during all the stages. In contrast, Kantojärvi and Karjalainen (2014:15) state that a medication process, consisting of preparation and administration of the same drug was the observed phenomenon.

The other contrasting component of the studies is the number of documented events. Whilst we tended to have a single documented event for one medication process in every observation chart item, Rautajuuri and Toivonen (2012:20) have fluctuating number of events throughout the observation. Utti and Veltheim (2014:19) observed 29 medication processes and documented 224 hand disinfection events. That fact might have significant effect on the compatibility of the results between the different observers.

Utti and Veltheim used different approaches in using the observation chart. For instance, in the preparation of medication, we checked the expiration date of medication during the preparation process, despite the fact that healthcare personnel did not check it. On the other hand, the Utti and Veltheim (2014:24) assessed the medication to be expired in all of the cases, when the healthcare personnel did not remember to check these before preparing. This gave variable results in the expiration of medication.

Furthermore, there was a difference in the assessing of the skin around cannula. We observed it to be healthy, when we did not see any swelling or redness around the cannula sticker. For some patients at the medical ward, the elastic bandage was wrapped around the cannula site to cover it, therefore, we were required to interrupt the medication process and ask the nurse if we could see the skin under this elastic bandage. However, Utti and Veltheim (2014:25) assessed the skin around the cannula to be unhealthy in all of the cases when a nurse did not check it before administrating the medication. This gave very dissimilar results about the healthiness of the skin around cannula, because Utti and Veltheim (2014: Appendix 5) found that in majority of cases, the skin around cannula was not healthy.

The appropriate hand disinfection technique gave controversial findings in both observation studies. Both observations showed noticeable lacking in the rubbing fingertips against palm, rubbing palms together with interlaced fingers, rubbing the backs of both hands with fingers interlaced, rubbing both thumbs separately and rubbing flexed fingers together (Utti and Veltheim 2014: Appendix 5). We noticed in majority of cases, that the hand disinfection did not last the required time, 30 seconds. Additionally, healthcare professionals did not apply enough hand gel when disinfecting the hands, which might explain the insufficient duration of hand disinfection. Previous observation studies also showed defects in the hand disinfection. Utti and Veltheim (2014: Appendix 5) concluded into similar findings about insufficient duration of hand disinfection and amount of hand gel. Rautajuuri and Toivonen (2012: 20) found that in general, the hand disinfection did not last the required time; however, positive aspect on the sufficient amount of hand gel applied was noticed.

We noticed that in all of the medication processes, the patient identity was never checked. Utti and Veltheim (2014: Appendix 5) noticed same inaccuracy in that; in majority of the cases the patient identity was not checked by a nurse. As mentioned before, this was for the reason that majority of the patients were long term patients, therefore the nurses did not have a reason to recheck the identity of familiar patients.

The major difference in the part of administration of medication was in the residual infusion. In all of the medication processes we observed, administration of the medication always occurred through the infusion pump. Therefore, we noticed residual infusion to be in all of the medication processes due to the form of the piercing device that

did not allow all the medication to pass from the bottle. On the other hand, Utti and Veltheim (2014: 22) assessed that residual infusion was only in half of the medication processes, because in some of the medication processes they observed, the medication was administered through syringe infusion pump which did not leave any residual infusion.

6.3 Proposals for the future studies

Using structured quantitative observation and aiming for consistent and valid results, some in advance preparations could have been done prior the observation. Firstly, essential consideration should be devoted to the piloting stage of the data collection. The observers might have benefited from reflecting on the piloting process. The reflection should have concentrated on analysing the practical approaches to document every item of the observation chart.

For example, observers should have agreed in advance how to organize recording of the time frame of a hand disinfection process, and document the technique simultaneously. The uncoordinated actions led to noticeably different results in the beginning. A profound pilot testing would also allow observers time to reflect and discuss each item in observation chart in depth, generating precise fulfilment criteria of each item, facilitating more reliable and consistent results.

Moreover, the observers should have discussed in advance how the observation situation occurs in general. For instance, the distance of observing the phenomenon was debatable for observers. Both observers had different way of observing, since one observer preferred to keep distance from the observed phenomenon, aiming to minimize personal interference into the scene, whereas the other observer preferred observe from near distance in order to see everything accurately. Observing the phenomenon from different distance and angle might lead to unreliable results in observations.

6.4 Validity

The data is collected according observation chart and analysed to present the quantitative results. To validate the observation chart, observers conducted data search and explored previously carried out studies, according to principles of non-judgement and

objectivity. The pilot testing of the observation chart was done before actual observation, increasing validity of the observation. Validity can be defined as ability of data collection tool to measure the phenomena under study. (Moule and Goodman 2009:184).

The content validity shows how relevant each item inside the questionnaire, is to the phenomenon studied (McGartland Rubio, Berg-Weger, Tebb, Lee and Raunch 2003: 94). In other words, how well each item in the observation chart describes and produces data to answer the study question of our final project. The observation chart originates from TOLA and it outlines statements that should be fulfilled to perform right intravenous medication therapy. The identical chart was previously used to conduct similar research and proved to be reliable.

The observation chart was subject to pilot testing in the field to prove its credibility and usability. Bowling (2002:358) mentions that during an observation an observer systematically looks and listens and then documents the results. Observation has limitations of not offering valid data, because when the objects or objects performing the action observed are aware of being watched, they may act differently than normally and therefore the observer may not discover the true actions of the subject (Järvinen and Järvinen 2004:155). For that reason two observers conducted the observation simultaneously and endeavored to avoid interference into the scene.

6.5 Ethics of research

To carry out this final project in terms of ethics, a formal permission was asked prior the research at the ward. Many ethical themes arise during this final project and therefore in advance preparation should be implemented to avoid any harm. Moule and Goodman (2009:57) state that not only the methods and actions of the research, but also its topic have to be ethical. The topic of this final project does not provoke any ethical issues.

To make observation study possible, an official permission was requested from Medisiininen tulosyksikkö of HUS. The permission was granted based on the application in which the observers stated the topic, study question and purpose of the study. Short description of the study was included together with the information about the university and contact information of supervisors. Together with application, researches signed the confidentiality form. In this form, observers engaged themselves from leaking out

any personal information related to respondents' identity. Additionally, observers complied to follow the HUS regulations and guidelines.

Furthermore, to ensure the ethics in this final project, an information letter was sent to medical ward, before the observation started. The information letter contained observation study topic, researches' contact information, a concrete data collection plan and estimated time for data collection, the purpose of the observation study. The information letter is presented in Appendix 7. Before initiating the observation study at the ward, observers personally introduced themselves at the medical ward and held a short presentation about the coming observation. Additionally, observers encouraged the healthcare personnel to ask questions regarding the observation.

The foundation for each research is that every participant should have anonymity to their participation. This is a point that has to be initially mentioned to participants when introducing them to the research. Anonymity allows observers to look into issues that are viewed as delicate in order to gain honest and reliable research outcomes. (Oliver 2003:78.) In this final project anonymity and confidentiality of participants was considered. The personnel of the ward was informed about anonymity and voluntariness of the participation at the presentation. The personnel was given a dignified opportunity to refuse from participating before the beginning of the observation. The observation chart did not allow personal data leakage or misuse since no personal data was recorded. The observation results were presented as aggregated numerical data, which makes it impossible to recognize any individual participant.

References

Ahtiala, M., Ask, O., Hietanen, H., Juutilainen, V., Kanerva, M., Koljonen, V., Kontinen, V., Kuokkanen, H., Lagus, H., Lindford, A., Malmgren, Kirsi., Pukki, T., Saarikko, A., Sane, T., Schwab, U., Suvilehto, J., Tenhunen, E., Vaalasti, A., Vikatmaa, P., Virkki, P. and Vuola, J. (2012) *Haavanhoidon periaatteet.* Helsinki: Sanoma Pro OY

Berman, A. and Snyder, S. J. (2012) *Kozier and Erb's Fundamentials of Nursing Concepts, Process, and Practice*. Upper Saddle River: Pearson.

Biotechnology. Performance criteria for microbiological safety cabinets. (2000). Brussels: CEN.

Bowling, A. (2002) *Research Methods in Health: Investigating Health and Health Services*. Berkshire: Open University Press.

Crouch S., Chapelhow C., and Crouch M. (2008) *Medicines management a nursing perspective.* Harlow: Pearson Education.

Curran, E. (2011) Intravenous medication preparation: the infection risks. *British Journal Of Nursing*, 14(20), 4.

Elliott, M. and Liu, Y. (2010) The nine rights of medication administration: an overview. *British Journal of Nursing*, 19(5), 300-305.

Hughes, R.G. (ed.) (2008) *Patient Safety and Quality: An Evidence-Based Handbook for Nurses.* Rockville (MD): Agency for Healthcare Research and Quality.

Huovinen, P. (2013) *Mikrobilääkkeiden käytön ekologia*. <http://www.terveysportti.fi.ezproxy.metropolia.fi/dtk/ltk/koti?p_artikkeli=ykt00030andp_haku=antibiootti> Read 24.3.2014

Ingram, P. and Lavery, I. (2005) Peripheral intravenous therapy: key risks and implications for practice. *Nursing Standard* 19(46), 55.

Jamieson, E. M., McCall, J. M. and Whyte, L.A. (2007) *Clinical nursing practices.* Edinburgh: Churchill Livingstone Elsevier.

Järvinen, P. and Järvinen A. (2004) *Tutkimustyön Metodeista*. Tampere: Oppipajan Kirja.

Kantojärvi, M., Karjalainen, E. (2013) *Aseptiikka ja lääkkeenannon oikeellisuus laskimonsisäisessä antibioottihoidossa: strukturoitu havainnointi.* Opinnäytetyö. Helsinki: Metropolia Ammattikorkeakoulu.

Larmila, M. (2010) *Mikrobilääkehoidon yleisperiaatteet*. <http://www.terveysportti.fi.ezproxy.metropolia.fi/dtk/aho/koti?p_artikkeli=tht00245andp_haku=antibiootti> Read 24.3.2014

LiBiondo-Wood, G. and Haber, J. (2010) *Nursing Research Methods and Critical Appraisal for Evidence-Based Practice*. St. Louis: Mosby.

McGartland Rubio, D., Berg-Weger, M., Tebb, S.S., Lee, E.S. and Raunch, S. (2003) Objectifying content validity: Conductiongt a content validity study in social work research. *Social Work Research*, 27 (2), 94-104.

Morris, W. and Tay, M. (2008) Strategies for preventing peripheral intravenous cannula infection. *British Journal Of Nursing*, 17(19), 14.

Moule, P. and Goodman, M. (2009) *Nursing Research: An Introduction*. London: Sage.

Moule P., Goodman, M. (2013) *Nursing Research: An Introduction*. London: SAGE Publications.

Muijs, D. (2004) *Doing Quantitative Research in Education*. London: Sage Publications.

Männistö, P. T. and Tuominen, R. K. (2001) *Yleistä mikrobilääkkeistä*. <http://www.medicina.fi/fato/50.pdf> Read 24.3.2014

Nurminen, M.-L. (2011) *Lääkehoito*. Helsinki: Sanoma Pro Oy.

Oliver, P. (2003) *The Student's Guide to Research Ethics*. Philadelphia: Open University Press.

Rekola, L., Korhonen, E-S., Renholm, M., Vuorinen, R. (2013) *TOLA - Toimintamalli laskimosisäisestä lääkkeenannon oikeellisuudesta Kehittämishanke*. Helsinki.

Thomas, M., Sanborn, M. and Couldry, R. (2005) I.V. admixture contamination rates: traditional practice site versus a class 1000 cleanroom. *American Journal Of Health-System Pharmacy*, 62(22), 2386.

Troy, D. B. (ed) (2006) *Remington: The Science and Practice of Pharmacy*. Baltimore: Lippincott Williams and Wilkins.

Utti, H., Veltheim, S. (2014) *Lääkkeenannon oikeellisuus perifeerisessä laskimonsisäisessä mikrobilääkehoidossa: havainnointitutkimus.* Opinnäytetyö. Helsinki: Metropolia Ammattikorkeakoulu.

WHO (2009) *WHO Guidelines on Hand Hygiene in Health Care: a Summary*. Geneva: Who Press.

Appendix 1

Observation chart for the structured observation in Finnish

HAVAINNOINTILOMAKE LÄÄKKEENANNON OIKEELLISUUDEN JA ASEPTIIKAN TOTEUTUMISESTA
1.Taustatietoja havainnointitilanteesta:
2. Havainnoitavan ammattinimike:
3. Havainnoitavan työkokemus vuosina:
4. Havainnoitsijat:
5. Havainnointikerta:
6. Päivämäärä:
7. Kellonaika:
8. Lääke:
9. Muuta huomioitavaa havainnoinnissa:

A) Hoitajan henkilökohtainen hygienia	Kyllä	Ei	Muuta huomioitavaa:
10. Pitkät hiukset ovat kiinni			
11. Koruja			
12. Sormuksia			
13. Rannekello			
14. Kynsilakkaa			
15. Rakennekynnet			
16. Käsien ihon kunto on hyvä			
17. Muuta: työasun asianmukaisuus (ei vilutakkia ym.)			
B) Käsihygienian toteutuminen			
Kädet desinfioitiin			
18. Desinfiointi ennen lääkkeen valmistelua			
19. Ennen potilaskontaktia			
20. Jälkeen potilaskontaktin			
21. Ennen suojakäsineiden pukemista			
22. Jälkeen suojakäsineiden riisumisen			
23. Kädet eivät ole näkyvästi likaiset, jos on kohta muuta*			
24. Muuta: * toteutuuko käsien pesu			
Tekniikka hallussa			
25. Hierotaan sormenpäitä toisen käden kämmentä vasten			
26. Hierotaan kämmeniä vastakkain siten, että sormet menevät lomittain			
27. Hierotaan kämmenselät vuorotellen, sormet lomittain			
28. Hierotaan molemmat peukalot erikseen			
29. Hierotaan sormia koukistettuna vastakkain			
30. Riittävän kauan (30 sekuntia)			
31. Käsihuuhdetta on riittävästi (3 -5 ml)			
32. Käsidesinfiointi laitettiin kuiviin käsiin			
33. Muuta			

C) Lääkkeen valmistaminen	Kyllä	Ei	Muuta huomioitavaa:
34. Lääke on oikea			
35. Annos on oikea			
36. Suojakäsineitä käytettiin lääkkeen valmistelun yhteydessä			
37. Infuusioletkujen ilmattomuus varmistettiin			
38. Lääkkeen päivämäärä on voimassa			
39. Lääke on säilytetty oikein			
40. Perforoitava pinta puhdistetaan antiseptisellä puhdistusaineella ennen siirtokanyylia tai infuusioletkua			
41. Infuusiojäännös			
42. Lääkkeenlisäystarran täyttö on ohjeenmukainen			
43. Säilytysaika ennen potilaalle vientiä ohjeenmukainen			
44. (Laminaari) Suojatakki			
45. (Laminaari) Hengityssuojain			
46. (Laminaari) Steriilit suojakäsineet			
47. (Laminaari) Hiussuojain			
48. (Laminaari) Steriili liina			
49. Muuta:			
D) Lääkkeen anto potilaalle			
50. Vanhojen infuusioletkujen käyttö			
51. Mikäli vanha infuusioletku, onko se aseptisesti telineessä			
52. Varmistus potilaan henkilöllisyydestä tehtiin			
53. Lääkkeen antoaika on oikea (minuutit määrätystä ajasta)			
54. Lääkkeellä on oikea tiputusnopeus			
55. Infuusiojäännös			
56. Infuusioletkun huuhtelu			
57. Muuta:			
E) Laskimokanyyli			
58. Laskimokanyyli on käyttökunnossa			
59. Laskimokanyylin juuren iho on terve			
60. Muuta:			

Appendix 2

Observation chart for the structured observation translated into English

Observation chart of intravenous therapy accuracy and aseptic technique
1. Background information of observed situation:
2. Professional tittle of worker:
3. Professional experience in years of worker
4. Observers:
5. Serial number of observation
6. Date:
7. Time:
8. Medication
9. Other

Modified in TOLA-project meeting at 6.11.2013

Unofficial translation by Spännäri, Nguyen, Ermakov, Määttä

A) Personal hygiene of nurse	Yes	No	Other:
10. Long hair tied up			
11. Jewelries			
12. Rings			
13. Wristwatch			
14. Nail polish			
15. Artificial nails			
16. Skin condition on hands is good			
17. Other: Uniform according to hospital policy (no jacket etc.)			
B) Fulfilment of Hand hygiene			
Hands have been disinfected			
18. Disinfection before preparation of medication			
19. Before patient contact			
20. After patient contact			
21. Before wearing protective gloves			
22. After removal of protective gloves			
23. Hands are not visibly soiled, if yes fill in Question 24*			
24. Other: * Hands have been washed			
Appropriate technique			
25. Rubbing fingertips against palm			
26. Rubbing palms together with interlaced fingers			
27. Rubbing the backs of both hands with fingers interlaced			
28. Rubbing both thumbs separately			
29. Rubbing flexed fingers together			
30. Lasts long enough (30 seconds)			
31. Enough hand gel is applied (3-5ml)			
32. Hand gel is applied onto dry hands			
33. Other:			

Modified in TOLA-project meeting at 6.11.2013

C) Preparation of medication			
34. Correct medication			
35. Correct dose			
36. Gloves were used while preparation			
37. Infusion set does not contain air after assembling			
38. Medication has not expired			
39. Medication is stored correctly			
40. Medication container perforated surface is cleaned with antiseptic agent before attaching transport cannula or infusion set			
41. Residual infusion			
42. Medication container is marked according to local policy			
43. Medication storage time before administration is appropriate according to instructions			
44. Laminar airflow cabinet, apron			
45. Laminar airflow cabinet respirator			
46. Laminar airflow cabinet Sterile gloves			
47. Laminar airflow cabinet Nursing cap			
48. Laminar airflow cabinet Sterile drape			
49. Other:			
D) Administration of medication			
50. Use of old infusion set			
51. If old, is it aseptically preserved in stand			
52. Patient identity is checked			
53. Correct time (minutes from prescribed time)			
54. Correct infusion drop rate			
55. Residual infusion			
56. Rinse of infusion set			
57. Other:			
E) Intravenous cannula			
58. Cannula is usable			
59. Skin around cannulation site is healthy			
60. Other:			

Modified in TOLA-project meeting at 6.11.2013
Unofficial translation by Spännäri, Nguyen, Ermakov, Määttä

Appendix 3

Observation results. Section A: personal hygiene

A) Personal hygiene of nurse	Observer 1		Observer 2		Correspondence rate
	Yes	No	Yes	No	
10. Long hair tied up	25	0	25	0	100 %
11. Jewelries	0	25	0	25	100 %
12. Rings	0	25	0	25	100 %
13. Wristwatch	0	25	0	25	100 %
14. Nail polish	0	25	0	25	100 %
15. Artificial nails	0	25	0	25	100 %
16. Skin condition on hands is good	25	0	25	0	100 %

Appendix 4

Observation results. Section B: Fulfilment of hand hygiene.

B) Fulfilment of Hand hygiene	Observer 1		Observer 2		Correspondence rate
Hands have been disinfected	Yes	No	Yes	No	
18. Disinfection before preparation of medication	22	3	24	1	92 %
19. Before patient contact	20	5	23	2	88 %
20. After patient contact	25	0	25	0	100 %
21. Before wearing protective gloves	9	1	9	0	90 %
22. After removal of protective gloves	10	0	9	0	90 %
23. Hands are not visibly soiled, if yes fill in Question 24*	25	0	25	0	100 %
24. Other: * hands have been washed					
Appropriate technique					
25. Rubbing fingertips against palm	10	26	0	36	72 %
26. Rubbing palms together with interlaced fingers	36	0	30	6	83 %
27. Rubbing the backs of both hands with fingers interlaced	25	11	24	12	97 %
28. Rubbing both thumbs separately	21	15	29	7	78 %
29. Rubbing flexed fingers together	18	18	24	12	83 %
30. Lasts long enough (30 seconds)	5	31	0	36	86 %
31. Enough hand gel is applied (3-5ml)	15	21	0	36	58 %
32. Hand gel is applied onto dry hands	33	3	35	1	94 %

Appendix 5

Observation results. Section C: Medication preparation.

C) Preparation of medication	Observer 1		Observer 2		Correspondence rate
	Yes	No	Yes	No	
34. Correct medication	25	0	25	0	100 %
35. Correct dose	25	0	25	0	100 %
36. Gloves were used while preparation	25	0	25	0	100 %
37. Infusion set does not contain air after assembling	25	0	24	1	96 %
38. Medication has not expired	25	0	25	0	100 %
39. Medication is stored correctly	25	0	25	0	100 %
40. Medication label perforated surface is cleaned with antiseptic agent before attaching transport cannula or infusion set	24	1	24	1	100 %
41. Residual infusion	16	9	18	7	92 %
42. Medication label is marked according to local policy	0	25	1	24	96 %
43. Medication storage time before administration is appropriate according to instructions	25	0	25	0	100 %
44. Laminar airflow cabinet, apron	0	24	0	23	96 %
45. Laminar airflow cabinet respirator	0	24	0	23	96 %
46. Laminar airflow cabinet Sterile gloves	0	24	0	23	96 %
47. Laminar airflow cabinet Nursing cap	0	24	0	23	96 %
48. Laminar airflow cabinet Sterile drape	0	24	0	23	96 %
49. Other:					

Appendix 6

Observation results. Sections D and E: Administration of medication and cannula area.

D) Administration of medication	Observer 1		Observer 2		Correspondence rate
	Yes	No	Yes	No	
50. Use of old infusion set	15	10	16	9	96 %
51. If old, is it aseptically preserved in stand	15	0	16	0	94 %
52. Patient identity is checked	0	25	0	25	100 %
53. Correct time (minutes from prescribed time)	24	1	18	7	76 %
54. Correct infusion drop rate	20	5	23	2	88 %
55. Residual infusion	25	0	25	0	100 %
56. Rinse of infusion set	25	0	25	0	100 %
57. Other:					
E) Intravenous cannula					
58. Cannula is usable	25	0	25	0	100 %
59. Skin around cannulation site is healthy	24	1	19	6	80 %

Appendix 7
Information letter to the medical ward

Hyvä osasto-X työntekijät,

Tällä kirjeellä informoimme teitä tulevasta opinnäytetyön aineistonkeruusta, jonka tulemme suorittamaan teidän osastollanne. Olemme 4 sairaanhoidon opiskelijaa Metropolian Ammattikorkeakoulusta ja opinnäytetyömme ovat osa tutkimus- ja kehittämishanketta, joka on HYKSin ja ammattikorkeakoulun yhteinen. Hankkeen nimi on TOLA- (Toimintamalli Laskimonsisäisestä Lääkkeenannon Oikeellisuudesta -hanke).

Opinnäytetyömme koskevat laskimonsisäisen lääkkeenannon oikeellisuutta (Accurate peripheral intravenous medication). Tarkoituksena on kuvata, miten laskimonsisäisen lääkityksen anto toteutuu osastollanne. Opinnäytetyön aineistot kerätään havainnoimalla koko laskimonsisäisen lääkkeenanto- prosessia. Opinnäytetyömme tulokset palvelevat TOLA-hanketta ja lääkehoidon kehittämistä HYKS:ssä.

Aineistonkeruu toteutetaan helmikuussa 2014 ja kestää noin kaksi viikkoa. Sen aikana tulemme osastolle ja havainnoimme miten IV lääke valmistellaan, säilytetään ja annetaan potilaalle. Yritämme parhaamme mukaan olla häiritsemättä osaston päivätoimintaa. Ennen varsinaista aineistonkeruuta tullemme suorittamaan yhden pilotoinnin, joka kestää korkeintaan yhden työvuoron. Osallistuminen aineistonkeruuseen on vapaaehtoista, anonyymia ja luottamuksellista. Me sitoudumme noudattamaan HUS:in ja osaston sisäisiä toimintaperiaatteita ja sääntöjä sekä työskentelemään eettisesti.

Odotamme mielenkiinnolla teidän tapaamista ja olemme valmiita antamaan lisää informaatiota opinnäytetyöstämme.

Ystävällisin terveisin,

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